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**Field Engineering
Corporation**

Grand Junction Operations
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PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Nuclear Energy
Grand Junction Area Office, Colorado

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1981 Environmental Monitoring Report
U.S. Department of Energy Facilities
Grand Junction, Colorado
and Monticello, Utah

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GRAND JUNCTION AREA OFFICE, DOE

The Grand Junction Area Office (GJAO), U.S. Department of Energy (DOE), develops and administers programs for evaluating domestic uranium resources and the production capability of industry; for developing resource planning information for DOE; and for advancing geologic and geophysical exploration concepts and techniques. In addition, GJAO administers the leasing of mineral lands under DOE control, and carries out activities relating to the environmental aspects of uranium mining and milling, including remedial programs. The Office is staffed by administrative and technical program-management personnel. Bendix Field Engineering Corporation (Bendix), is the DOE operating contractor at the Grand Junction, Colorado, government-owned/contractor-operated (GOCO) facility. The technical staffs of both GJAO and Bendix are primarily geoscience-oriented.

The DOE Grand Junction facility is located on a 48.6-acre tract along the Gunnison River, south of the city of Grand Junction. Forty-three buildings house the many functions of the organization.

The Monticello, Utah facility covers a tract approximately 77 acres in size. This area is fenced with four access gates. This site contains an estimated 900,000 tons of stabilized radioactive mill tailings.

AREAS OF CONCERN AND ACTIVITIES

The effect the Grand Junction, Colorado and Monticello, Utah facilities have on the environment is reflected by the analyses of air, water, and sediment samples. The off-site water and sediment samples were taken to determine what effect the tailings and contaminated equipment buried on the sites may have on the air, water, and adjacent properties.

GRAND JUNCTION

Previous reports, particularly 1979 and 1980, have established that there are essentially no air quality problems except a minor one from the chemistry laboratory. There is possible contamination of water in the Gunnison River and the shallow aquifer underlying the facility from buried uranium mill tailings and related wastes.

All facility waste water and sewage discharge points were connected to the city sewer system during 1981. This eliminated the use of an open sewage lagoon known as the South Pond. The buried uranium mill tailings remain a contamination threat to both ground and surface water.

AIR QUALITY

Sample Plant

During 1981, the Sample Plant prepared approximately 400 samples per month. The majority of these samples were not uranium ores but exploration samples of low radioactivity. Thus, the principal environmental concern is dust generated from the grinding and crushing.

The low radioactivity was demonstrated by air sampling performed in the Sample Plant during July 1980. The sampling was done while ore samples were being prepared. The most concentrated sample contained 0.0046 mg/m³ of uranium. The relevant American Conference of Governmental Industrial Hygienists (ACGIH) standards are 0.2 mg/m³ for uranium. Occasionally, very high grade uranium or thorium ore (5 to 10 percent U₃O₈ or ThO₂) is handled in the preparation of calibration models. This operation could produce dust which exceeds the uranium-in-dust standard.

A baghouse is used for collecting dust generated by the crushing and pulverizing operations. Up to two 55-gallon drums of waste material are collected in a year. These drums are stored above ground in the buried tailings area. Considering the low levels of toxic materials in the dust and the efficiency of the baghouse (approximately 99 percent), the potential for air pollution from the Sample Plant is slight.

Analytical Laboratory

The Analytical Laboratory performs a wide variety of chemical and physical tests, often employing mineral acids for the digestion of rock samples. These digestions are performed in any 1 of 10 fume hoods. Combinations of hydrofluoric, sulfuric, nitric, hydrochloric, and perchloric acids are used in these digestions; all of these acids are highly toxic.

During 1980, new fume hoods with scrubbers were installed. Ventilation within the building is excellent. The scrubbers do not effectively remove perchloric acid. Visible emissions during 10 minutes of the perchloric acid digestions fail the State of Colorado Opacity Standard (Regulation 1A-1). This year the visible emissions were not as frequent as in the past because fewer analyses requiring the use of perchloric acid were performed. Personnel at this facility are currently working on the problem.

Emissions from Combustion

Automobiles. The activities of concern are the automobiles that deliver the population of approximately 500 persons to the facility and the limited automobile activity within the facility. The facility is located in a rural area and there is no traffic congestion. The principal air pollutants emitted by automotive sources are carbon monoxide, nitrogen oxides, and unburned hydrocarbons. The Ambient Air Quality Standards of the U.S. Environmental Protection Agency (EPA) for these pollutants are as follows:

Carbon Monoxide	9 ppm	8 hr. avg.
	35 ppm	1 hr. avg.
Nitrogen Oxides	0.05 ppm	annual avg.
Hydrocarbons	0.24 ppm	3 hr. avg.

Neither of the automotive activities associated with the facility, even during periods of construction and enhanced activity, would cause these levels of air pollutants to be exceeded.

Central Heating Plant. The Heating Plant includes two main natural-gas-fired steam boilers: a Babcock and Wilcox Boiler rated at 17,250 lb/hr and a Keeler Boiler rated at 8,400 lb/hr (264 hp). One small natural-gas-fired package boiler is also available for use when heating requirements are low. When both the large boilers are operating at full load, they will generate approximately 35×10^6 BTU per hour, and will produce about 0.2 lb/hr (0.03 g/sec) of nitrogen oxides (NO_x) in the stack gas. This level of NO_x in the stack gas will not cause a significant increase of NO_x concentrations in the ambient air beyond a radius of 5 meters from the stack except during air inversions. The Central Heating Plant emits no other air pollutants in significant quantities.

Other Sources. Other minor combustion points at the facility (one individual building boiler, hot water heaters, etc.) produce negligible quantities of air pollutants.

Radioactive Emissions

Current operations at the Grand Junction facility do not emit significant quantities of radiation into the atmosphere. Both the Sample Plant and the Analytical Laboratory emit less than 1 microcurie of radon per year.

The only appreciable discharge of radiation to the atmosphere comes from the buried tailings area. Thirty-thousand tons of uranium mill tailings, contaminated equipment, and ore samples have been buried just north of the sewage lagoon. No activities are conducted within the tailings burial site and the area is fenced and posted. Radon flux measurements taken during May 1979 are shown in Table 1.

Table 1. Radon Flux Measurements, Grand Junction Facility

<u>CANISTER</u>	<u>LOCATION</u>	<u>FLUX</u> <u>pCi/m²-S</u>
A	E of tailings, 30 ft W of road	50.2 \pm 3.2
B	E edge of tailings, on berm. 50 ft W of road	106.6 \pm 4.2
C	Center of 1962-1970 burial area	25.3 \pm 2.8
D	"R" pit zone	10.3 \pm 2.4
E	Airport pad cleanup area	3.1 \pm 1.4
F	Lignite burial area	47.1 \pm 3.4
G	Among buried barrels, 10 ft N of D	4.6 \pm 1.4
H	On berm., center of tailings area	20.7 \pm 2.7
I	NE quadrant of tailings area	70.1 \pm 4.1
J	NW quadrant of tailings area	52.0 \pm 3.6
K	SE quadrant of tailings area	45.2 \pm 3.5
L	SW quadrant of tailings area	64.0 \pm 4.0

EPA proposed standard for inactive uranium mill tailings is 2.0.

WATER MONITORING

The water monitoring program at the Grand Junction facility has improved considerably in the past 2 years. Formerly, samples were collected as grab samples with little attention paid to preservation methods and holding times. During 1981, all samples were collected using EPA prescribed methods, as described in Methods for Chemical Analysis of Water and Wastes, United States Environmental Protection Agency, EPA-600/4-79-020, March 1979. These methods require that both filtration and preservation of samples be carried out at the sampling site. Also, that measurements of pH, conductivity, and alkalinity be performed in the field.

The Grand Junction facility lies within a bend of the Gunnison River. There is no point source discharge to the surface water but uranium milling, analysis, and U_3O_8 storage were all carried out on the site for 25 to 30 years. There is one area designated on the facility as a buried tailings area. Recent trenching and previous surveys have indicated that there are "hot" spots at several places outside of the tailings area.

Surface Water

Data for the surface water sites on the facility itself are shown in Tables 2 and 3. Sample locations are shown in Figure 1.

North Pond: The analyses of water samples taken from the North Pond reflects high concentrations of radium and uranium when compared to EPA standards. These result from past burial of contaminated materials. The actual source and quantity of material buried is unknown. Formerly, the pond received a small amount of sewage wastes but now only receives some storm runoff.

Drainage Ditch: The water in the contained drainage ditch along the west boundary of the facility is the most highly contaminated surface site. Tailings from the nearby "buried tailings area" were either dumped in the ditch or have leached into it. The ditch receives some overflow from the South Pond but the water level seems primarily to rise and fall with the river level. The ditch lies outside of the facility fence and is within a large dike alongside the river. Arsenic, molybdenum, uranium, and radium all exceed EPA criteria with the latter being 300 times the standard.

South Pond: The South Pond has been used primarily as a sewage lagoon but has also received wastes from the chemistry and petrology laboratories and surface storm water runoff. In December 1981, all buildings on the facility were connected to the city sewer system. At the same time, all septic tanks were disconnected and filled with gravel; thus, the only remaining sources to the pond are overflow from the fume hood scrubbers and storm drain runoff from the parking lot.

The water analyses indicate that none of the individual inorganic or radioactive contaminants are found in quantities exceeding EPA interim standards. Coliform was not measured in these samples. However, previous measurements have always resulted in abundances exceeding 75,000 counts/ml. The inadequacy of the pond as a sewage lagoon has been documented in previous reports and has been corrected.

Table 2. Grand Junction Surface Water Samples

Sample Site	Date Sampled	pH	mg/l Alky	Coliform Counts/100 ml	umhos/cm CDT	mg/l Ag	mg/l Al	mg/l As	mg/l Ba	mg/l Cd	mg/l Cl	mg/l Cr
W-4 North Pond	5-81	8.0	244	1300	4950	.005	.251	.015	.046	<.001	386	<.005
	10-81	8.0	310	--	5025	.005	.089	.032	.074	<.001	268	<.005
W-3 South Pond	5-81	7.0	147	--	775	.001	.328	.008	.035	<.001	--	<.005
	10-81	7.2	150	--	600	.0005	.045	.008	.046	<.001	84	<.005
W-5 Drainage Ditch	5-81	7.8	375	--	1325	<.0005	1.630	.265	.279	<.001	--	.004
EPA Standards						.05		.05	1.0	.01		.05
Sample Site	Date Sampled	mg/l Cu	mg/l F	mg/l Fe	mg/l Hg	mg/l Mn	mg/l Mo	mg/l Ni	mg/l NO ₃ -N	mg/l Pb	mg/l PO ₄	
W-4 North Pond	5-81	.019	0.6	.33	<.002	.49	.032	.044	.2	.001	1	
	10-81	.011	3	.1	<.002	.61	.039	.027	1	.001	<1	
W-3 South Pond	5-81	.004	--	.45	<.002	.072	.011	<.001	--	.008	--	
	10-81	.006	1	.3	<.002	.15	.009	.005	<1	.003	2	
W-5 Drainage Ditch	5-81	.049	--	4.20	.002	1.870	.72	.005	--	.010	--	
EPA Standards						.002	.05		10	.05		
Sample Site	Date Sampled	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l Se	mg/l SO ₄	mg/l V	mg/l Zn	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α		
W-4 North Pond	5-81	42	8.7	<.005	2136	<.005	.004	1.25	850	196		
	10-81	9	<1	<.005	2208	.09	.1	.45	306	448		
W-3 South Pond	5-81	34	5	<.005	--	<.005	<.001	<.001	<1	21		
	10-81	20	<1	<.005	87	.019	.07	.010	7	23		
W-5 Drainage Ditch	5-81	1500	14.5	.010	--	.077	.018	.8	546	1055		
EPA Standards									10	15		

Table 3. Gunnison River Samples

Sample Site	Date Sampled	pH	mg/l Alky	Coliform Counts/100 ml	µmhos/cm CDT	mg/l Ag	mg/l Al	mg/l As	mg/l Ba	mg/l Cd	mg/l Cl	mg/l Cr
W-1 Gunnison R. Upstream	5-81 10-81	8.2 7.8	107 180	500 --	625 1050	<.0005 <.0005	.494 .010	<.005 <.005	.086 .105	<.001 .001	7 10	<.005 <.005
W-6 Gunnison R. Midstream	5-81 10-81	7.9 7.8	97 190	300 --	655 1050	<.0005 <.0005	.068 .079	<.005 <.005	.071 .108	<.001 <.001	7 11	<.005 <.005
W-2 Gunnison R. Downstream	5-81 10-81	8.0 8.2	97 185	200 --	635 1100	<.0005 <.0005	.050 .062	<.005 <.005	.066 .093	<.001 <.001	-- 13	<.005 <.005
EPA Standards						.05		.05	1.0	.01		.05
Sample Site	Date Sampled	mg/l Cu	mg/l F	mg/l Fe	mg/l Hg	mg/l Mn	mg/l Mo	mg/l Ni	mg/l NO ₃ -N	mg/l Pb	mg/l PO ₄	
W-1 Gunnison R. Upstream	5-81 10-81	.056 .004	0.3 <1	.44 <.1	<.002 <.002	.080 .2	<.002 .009	<.005 <.005	1.4 6	.059 <.001	<1 <1	
W-6 Gunnison R. Midstream	5-81 10-81	.013 .005	0.2 <1	<.1 .1	<.002 <.002	.001 .04	<.002 .008	<.005 <.005	1.4 6	.003 <.001	<1 <1	
W-2 Gunnison R. Downstream	5-81 10-81	.050 .003	-- <1	<.1 .1	<.002 <.002	<.001 .03	.002 .008	.021 <.005	-- 6	.027 <.001	-- <1	
EPA Standards						.002	.05		10	.05		
Sample Site	Date Sampled	pCi/l ²²⁶ Ra	mg/l Se	mg/l SO ₄	mg/l V	mg/l Zn	mg/l U ₃ O ₈	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α		
W-1 Gunnison R. Upstream	5-81 10-81	5.6 10.8	.006 <.005	264 453	<.01 .015	.078 .01	.009 .005		6 3		10 9	
W-6 Gunnison R. Midstream	5-81 10-81	<1 10.0	.005 .009	264 415	<.01 <.01	.007 .03	.008 .008		5 5		7 15	
W-2 Gunnison R. Downstream	5-81 10-81	<1 11.9	.008 .009		<.01 .011	.073 .03	.007 .011		5 7		6 21	
EPA Standards		5	.01						10		15	

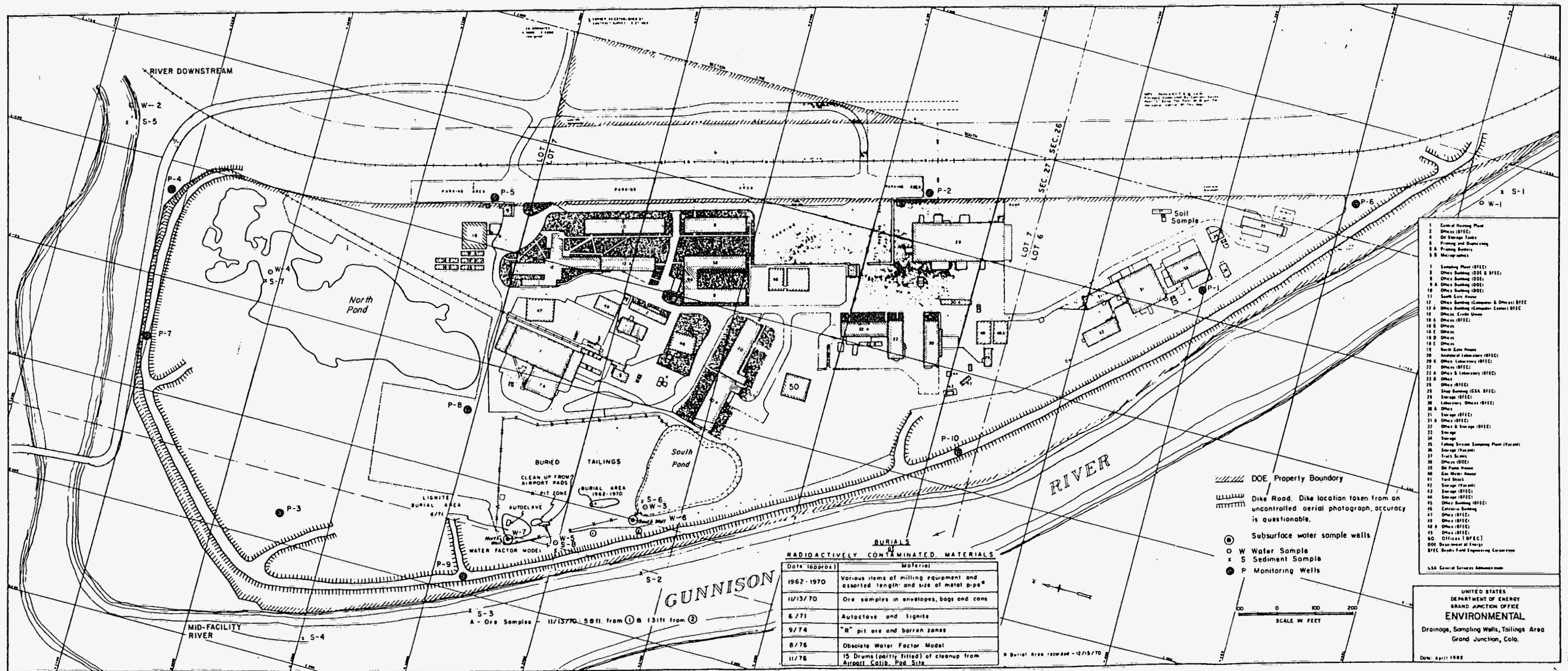


Figure 1. Drainage, Sampling Wells, Tailings Area - Grand Junction, Colorado

A brief hydrologic study conducted by Western Engineers indicated that the pond has effectively sealed itself and presents no danger to the ground water. As the pond dries up, however, the black malodorous sludge will be uncovered and may itself present a disposal problem. A study is underway to determine the cost to eliminate this pond.

Gunnison River: The Gunnison River was sampled upstream, alongside, and downstream from the facility. The results are shown in Table 3. Samples collected in May with the river flowing at 1,355 ft³/sec did not display any contamination; however, samples collected in October at a flow of 1,590 ft³/sec indicated slight contamination with Se and U. Gross alpha followed the same trend as Se and U but all of the measured values were below EPA standards. Radium did exceed the EPA guidelines, but the upstream and downstream samples contained essentially equal amounts.

Sediment samples collected and analyzed in 1980 indicated slight contamination of the river. Water samples collected in 1981 provide additional evidence of this problem. Consequently, it appears that the facility is a slight source of mill tailings contamination to the Gunnison River. During the year, river flow is adequate to dilute the contaminants. A very weak trend showing low levels of contamination is sometimes observable at low river flow.

Ground Water

Drilling Project: Previous environmental reports have emphasized the necessity for improved ground water monitoring. Accordingly, a contract was let with Western Engineers of Grand Junction to install wells on the facility. Their report describes the well installation and drilling logs. They also obtained log and completion information for the North and South Wells. The piezometer installation at each site is shown in Appendix A.

Four of the newly installed drill holes were fitted with two piezometers each. The shallow holes do not contain water except under a fairly high water table. Water found in these shallow wells would be representative of water moving through a formerly unsaturated zone. Analyses of samples from these wells may exhibit significantly different characteristics from the water taken near the alluvium/bedrock contact.

The locations of the new monitoring wells are shown in Figure 1. Drill holes P-1 and P-2 were expected to provide background information. Holes, P-3, P-4, P-6, P-7, P-9, and P-10 should provide information on contaminant movement below the dike and possibly into the river. Hole P-8 was placed in the center of the facility near the buried tailings area. Hole P-5 is in the excavation for a sewage lift station just outside the facility's east boundary.

Core was collected during the drilling project and analyzed to determine if tailings were present. These analyses are shown in Table 4. These data illustrate that appreciable tailings were not encountered during the installation of the sampling wells.

Data shown in Table 5 is from samples collected alongside the buried tailings area during the sewer excavation. These data are not expected to be representative of the buried tailings.

Table 4. Core Analyses from Drilling Project

Hole	Depth	ppm U	ppm eU	ppm Ag	ppm Ba	ppm Cd	ppm Cr	ppm Cu	% Fe	ppm Mn	ppm Ni	ppm Pb	ppm V	ppm Zn
P-1	0-4'	4	9	<1	688	1	14	10	2.3	443	9	16	74	80
1	4-7'	5	10	<1	836	<1	16	12	3.1	535	11	18	102	109
1	7-10'	3	4	<1	850	<1	18	11	3.0	536	13	16	111	71
1	10-11'	3	3	<1	1016	<1	20	16	3.2	759	11	14	102	57
1	11-13'	3	6	<1	702	<1	14	15	2.3	462	10	14	65	59
1	13-14'	3	2	<1	732	1	12	12	2.2	442	7	17	65	48
1	14-17'	4	10	<1	736	5	12	14	2.2	476	10	18	65	67
1	17-20'	5	9	1	932	<1	18	21	2.8	622	18	22	74	88
1	20-21'	4	2	<1	996	<1	20	26	2.3	742	13	18	111	72
1	23'	5	4	<1	2796	<1	12	16	2.6	1284	11	14	74	53
1	23' 6"	3	-	<1	3376	<1	14	14	2.8	1120	12	12	74	58
1	24'	3	-	<1	930	10	12	10	2.2	384	7	14	74	47
P-2	5'	5	5	<1	860	6	24	13	3.1	470	11	25	111	57
2	10-10.5'	3	2	<1	1056	<1	12	12	2.5	788	7	21	65	64
2	10-13'	3	4	3	844	1	16	11	2.4	475	13	14	74	44
2	13-15'	3	6	4	1016	<1	16	15	3.1	572	16	12	92	55
2	15-20'	3	6	2	816	<1	16	12	2.7	510	15	14	83	50
2	15-21'	3	2	1	756	1	18	16	2.6	537	12	15	74	51
2	20-23'	3	2	<1	656	<1	8	12	2.2	465	9	16	65	48
2	23.5-27'	3	1	<1	748	<1	20	15	2.6	542	14	23	83	56
2	27-29'	3	8	<1	808	<1	20	16	2.4	532	16	16	74	53
2	29-31'	3		<1	1366	<1	28	30	4.8	988	19	16	129	72
2	31-33'	3		1	992	<1	34	18	3.2	586	26	17	83	62
P-3	2'	3		1	372	1	31	14	1.7	235	22	16	96	72
3	5'	3		1	844	<1	14	15	2.1	513	13	13	57	46
3	10'	3		1	832	<1	14	15	2.4	533	13	14	67	48
3	15'	3		1	898	4	20	18	3.2	611	15	12	96	60
3	18'	2		<1	316	<1	15	9	1.3	166	13	11	48	41
3	20'	3		2	652	<1	13	15	2.4	511	12	11	76	48
P-4	0-5'	3		<1	598	4	12	9	1.8	338	8	11	57	36
4	5-10'	3		<1	734	1	14	12	2.6	499	11	12	76	44
4	10-15'	4		<1	768	<1	13	12	2.3	479	11	10	67	42
4	15-19'	4		<1	742	<1	18	13	2.9	536	14	14	96	56
4	20-22'	3		<1	836	10	13	20	2.8	648	12	13	86	60

Table 4. Core Analyses from Drilling Project (continued)

Hole	Depth	ppm U	ppm eU	ppm Ag	ppm Ba	ppm Cd	ppm Cr	ppm Cu	% Fe	ppm Mn	ppm Ni	ppm Pb	ppm V	ppm Zn
P-6	0-5'	1	5	<1	670	<1	17	10	2.0	437	11	13	70	48
6	5-10'	2	4	1	685	<1	14	11	2.2	500	13	18	74	55
6	10-10'7"	1	3	<1	879	<1	14	12	2.6	703	9	12	61	56
6	10-15'	2	6	<1	804	<1	17	10	2.1	478	11	9	62	42
6	15-20'	2	10	<1	774	<1	14	10	2.1	477	13	8	66	44
6	20-21'	1	5	<1	983	<1	21	19	3.2	783	14	4	95	58
6	21-25'	2	4	1	819	<1	14	12	2.3	506	12	13	68	46
6	25-29'	4	4	1	819	<1	14	12	2.3	526	12	10	68	48
6	29-30'	2	11	<1	322	<1	17	10	1.8	340	8	16	42	46
P-7	0-5'	1	7	<1	566	<1	14	10	1.6	505	8	9	52	33
7	5-10'	2	5	<1	730	<1	21	8	2.2	476	8	3	70	40
7	10-11'	2	3	<1	745	<1	17	9	2.2	494	9	7	70	47
7	11-15'	<1	4	<1	745	<1	17	7	2.5	443	8	4	69	39
7	15-20'	1	5	<1	1292	<1	17	9	2.7	513	10	8	71	41
7	20-21'	2	4	<1	864	<1	34	16	2.8	793	9	11	73	64
7	25-27'	2	1	<1	804	<1	17	11	1.8	403	10	11	52	34
7	30-30'11"	1	-	<1	278	<1	14	9	0.2	23	3	4	7	22
7	30'11"-32'	2	1	<1	685	<1	14	9	1.8	393	7	10	57	40
P-8	0-5'	2	1	<1	804	<1	93	8	2.8	520	10	8	86	48
8	5-10'	3	4	<1	760	<1	17	9	2.2	462	9	12	70	43
8	10-15'	3	2	<1	760	<1	14	9	2.3	500	9	12	75	48
8	15-20'	2	2	<1	800	<1	14	11	2.5	525	11	25	73	46
8	19-20'	<1	-	<1	338	<1	17	15	1.7	525	14	8	58	50
8	20-20'9"	<1	1	<1	292	<1	17	9	2.2	240	10	13	43	50
P-9	0-5'	2	3	<1	662	<1	14	9	2.2	432	13	10	73	47
9	5-10'	2	3	<1	754	<1	17	8	2.9	512	9	14	83	49
9	10-11'	2	12	<1	815	<1	14	11	2.7	536	10	10	73	53
9	11-15'	2	10	<1	892	<1	17	8	3.6	594	19	13	95	57
9	15-20'	2	5	<1	846	<1	17	9	3.0	598	13	8	85	46
9	20-25'	2	5	<1	662	<1	14	10	2.3	464	15	21	85	47
9	25-28'	1	4	<1	708	<1	14	11	2.1	480	7	7	67	39
9	30-31'	1	3	<1	231	<1	14	8	1.9	344	8	10	49	54
P-10	0-5'	1	4	<1	662	<1	17	9	2.1	444	10	7	70	39
10	5-10'	<1	4	<1	738	<1	17	8	2.8	496	8	7	82	47
10	10-10'5"	5	9	<1	708	<1	17	8	1.9	777	7	15	55	42
10	10-15'	1	9	<1	769	<1	17	8	2.6	503	11	9	82	50
10	15-20'	15	6	1	754	<1	17	14	2.4	495	12	5	88	41
10	20-25'	8	3	1	800	<1	17	19	2.7	569	11	12	90	48
10	25-30'	2	7	<1	1183	<1	17	17	2.9	686	12	14	80	58
10	30-30'4"	2	3	<1	1250	<1	14	11	3.0	925	5	7	28	54

Table 5. Tailings Excavated During Sewer Line Installation

	ppm U	ppm V	ppm Mo	ppm As	ppm Se
50 Ft. west of fire hydrant W-2 (by Bldg. 6)	114	617	112	58	< 2
42 Ft. west of hydrant W-2	139	367	126	58	< 2
West of Bldg. 39	4	242	13	8	12
Manhole west of Bldg. 33	140	292	38	40	4
Composite - between last manholes south end of A sewer line	513	1267	589	416	91

Data from all of the monitoring wells are shown in Table 6. All of the ground water samples were collected with a Masterflex peristaltic pump. At least two bore volumes were pumped from each well before the sample was collected.

Piezometers #2 and #6 are sampling background. All of the other piezometers display contamination. (All of the shallow piezometers and #5 were dry at the time of sampling.) Of most interest are piezometers 4, 7, 9, and 10 which are within 10 to 25 feet of the river. Gross alpha, Ra, Se, Mo, V, As, and U are all found in concentrations exceeding EPA interim standards in one or more of these wells. Mo contamination is particularly high with the concentration being as much as 50 times EPA standards.

The North and South Wells once again show significant contamination. Conclusions, due to the differences in concentration of the two samplings, cannot be drawn since the well bore was not pumped out for the first sampling because construction information was unavailable.

Summary

This last year was the first time the entire sampling and analysis program was carried out according to EPA standard procedures. It also was the first time river contamination was detected. Although the contamination of the river appears to be minimal, the alluvial aquifer underneath the facility is highly polluted by tailings. The leaching of these tailings will persist without remedial action. A more thorough hydrologic study to determine the actual threat the polluted ground water poses to the Gunnison River will be conducted. This current characterization study will be conducted by drilling 103 boreholes through the alluvium to bedrock (25 to 40 feet deep). The cores from these holes will show the depth and thickness of contaminants buried on the site. Thirty two of these wells will be used for subsurface water sampling. These samples should show the subsurface water contamination and the migration pattern of the water.

Clean up of the contaminated areas of the Grand Junction facility has been submitted for acceptance into the Surplus Facilities Management Program. Detailed environmental and/or engineering studies related to the clean up are scheduled to begin in FY1984.

Table 6. Ground Water Sampling at Grand Junction Facility

Sample Site	Date Sampled	pH	mg/l Alky	Coliform Counts/100 ml	µmhos/cm CDT	mg/l Ag	mg/l Al	mg/l As	mg/l Ba	mg/l Cd	mg/l Cl	mg/l Cr
W-6: South Well	5-81	6.8	432	--	1900	<.0005	.054	.275	.317	<.001		<.005
	10-81	7.4	480	--	1250	<.0005	.014	.268	.123	<.001	127	<.005
W-7: North Well	5-81	5.8	71	--	1425	<.0005	9.844	.420	.695	<.001	113	.010
	10-81	7.4	260	--	1050	<.0005	.013	.298	.125	<.001	102	<.005
P-1	10-81	7.7	190	--	1450	.002	.009	<.005	.078	<.001	68	<.005
P-2	10-81	7.6	200	--	1700	.001	.020	<.005	.097	<.001	41	<.005
P-3	10-81	7.5	380	--	2500	.003	.061	<.005	.079	<.001	95	<.005
P-4	10-81	7.4	460	--	5500	.005	.440	<.005	.078	<.001	447	<.005
P-6	10-81	8.0	210	--	1550	.0025	.021	<.005	.158	<.001	22	<.005
P-7	10-81	7.4	550	--	4500	.008	.029	<.005	.117	<.001	181	<.005
P-8	10-81	7.3	370	--	2500	.001	.010	.019	.087	.001	162	<.005
P-9	10-81	7.5	250	--	1150	<.0005	.015	.006	.112	<.001	64	<.005
P-10	10-81	7.7	180	--	1150	<.0005	.055	<.005	.119	<.001	25	<.005
EPA Standards						.05		.05	1.0	.01		.05

Sample Site	Date Sampled	mg/l Cu	mg/l F	mg/l Fe	mg/l Hg	mg/l Mn	mg/l Mo	mg/l Ni	mg/l NO ₃ -N	mg/l Pb	mg/l PO ₄
W-6: South Well	5-81	.004	--	10.60	<.002	6.0	.035	.007	--	<.001	--
	10-81	<.001	<1	1.7	<.002	3.6	.008	<.005	<1	.002	2
W-7: North Well	5-81	.088	1	9.38	<.002	2.50	.153	.016	67	.029	<1
	10-81	.003	<1	.4	<.002	2.97	.116	.007	<1	<.001	<1
P-1	10-81	.002	<1	.2	<.002	.77	.347	<.005	<1	<.001	<1
P-2	10-81	.002	<1	.4	<.002	1.6	.016	<.005	<1	<.001	<1
P-3	10-81	.008	1	.5	<.002	4.7	.520	.005	<1	<.001	<1
P-4	10-81	.013	5	3.2	<.002	3.4	.038	.031	<1	.004	2
P-6	10-81	.003	1	.2	<.002	.93	.021	<.005	<1	<.001	<1
P-7	10-81	.016	2	1.3	<.002	4.2	.520	.021	<1	.002	<1
P-8	10-81	.013	2	.1	<.002	.68	.038	.015	64	<.001	<1
P-9	10-81	.007	<1	.1	<.002	.69	.700	.010	18	<.001	<1
P-10	10-81	.003	<1	.5	<.002	2.1	.950	<.005	<1	<.001	<1
EPA Standards					.002		.05		10	.05	

Sample Site	Date Sampled	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l Se	mg/l SO ₄	mg/l V	mg/l Zn	mg/l U ₃₀₈	pCi/l U ₃₀₈	pCi/l Gross α
W-6: South Well	5-81	182	<1	<.005	--	.049	.008	.675	460	538
	10-81	17.0	<1	<.005	92	.026	.01	.026	18	59
W-7: North Well	5-81	<1	8.7	<.005	376	.109	.168	.320	218	207
	10-81	18.0	<1	<.005	237	.27	.05	.14	95	180
P-1	10-81	<1	<1	<.005	573	.011	.01	.08	54	160
P-2	10-81	13.6	1.5	.009	854	.019	.02	.007	5	17
P-3	10-81	10.3	7.2	<.005	1052	.015	.06	.49	333	280
P-4	10-81	11.7	4.9	<.005	3506	.045	.05	.054	37	162
P-6	10-81	<1	<1	<.005	554	.015	.01	.005	5	16
P-7	10-81	11.4	4.8	<.005	2058	.064	.07	.9	610	737
P-8	10-81	12.1	3.6	.028	1029	.3	.06	.14	95	191
P-9	10-81	<1	2.7	.015	160	.12	.04	.83	560	842
P-10	10-81	6.3	<1	<.005	312	.05	.03	.29	197	60
EPA Standards			5	.01					10	15

MONTICELLO

The Department of Energy site at Monticello, Utah was formerly a Government-owned uranium processing mill. The mill was operated for production of vanadium from 1941 to 1944, then taken over by the Atomic Energy Commission in 1948 and operated until January 1960 for the recovery of uranium. The site includes approximately 900,000 tons of radioactive tailing impounded in four separate tailings ponds, covering an aggregate area of approximately 40 acres.

During the life of the Monticello Mill, several techniques for uranium recovery were practiced. Initial recovery was by roasting coupled with a carbonate leach. In November 1955, an acid leach resin-in-pulp (RIP) process was initiated. The system was then reconverted to a carbonate process. The origin of the tailings is an important environmental consideration, since the various systems of uranium recovery tend to mobilize different materials.

Tailings dams were of the self-constructing variety, resulting in a dam composed of coarse sand, with fine slimes located in the middle of a pond area. The various types of resultant tailings material are shown on the facility map (Figure 2).

Efforts at site reclamation have done much to minimize the environmental effects of the Monticello facility, however environmental degradation continues.

This report will describe results from monitoring projects undertaken during FY1981. During this past year, all water samples were filtered and preserved on-site according to specifications published by the Environmental Protection Agency in Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979. All data described in previous reports were from unpreserved samples. Thus, comparisons should not be made with previous data. This past year also marked the first time the site was inspected by a chemical sampling crew. For these reasons, there are additional interpretations permitting the situation at Monticello to be described with greater clarity.

AIR QUALITY

Radon Emanation

Radon measurements were made on top of the covered tailings at Monticello during 1981 using the Radon-ON-Activated-Charcoal (ROAC) method. The sampling points are shown on Figure 2, and the average radon flux for samples collected on the tailings piles are shown in Table 7. Obviously, the radon emanation far exceeds the EPA interim standard of 2 pCi/m²'s. The actual emanation of the tailings is significantly attenuated by the overburden. The piles, however, continue to erode, and seepage at their base leads not only to increased water pollution but also to increased radon emanation as more tailings are exposed by leaching.

Table 7. Radon Flux on Tailings Piles

Sample Site	Tailing Pile	Average Flux (pCi/m ² -s)
R-1	Vanadium	43.95
R-2		
R-3	Carbonate	17.4
R-4	Acid	32.6
R-5		
R-6		
R-7	East	13.47
R-8		
R-9		
R-10		
R-11		
R-12		
R-13		

EPA proposed interim standard for inactive uranium mill tailings is 2.0.

SURFACE WATER

Surface water samples were collected in July, September, and November. Results from the established sampling sites are shown in Table 8. Sample locations are shown on Figure 2. No device has been installed to measure the flow in the creek. However, visual observations indicated that the flow in July was slightly greater than in September which, in turn, was slightly greater than in November.

The background site, W-3, contains background levels of all contaminants. There is an anomalous gross alpha measurement from the sample taken in November. However, the result only slightly exceeds the EPA standard and is within the error of the measurement.

Sample location W-2 is a permanent seep between the vanadium and carbonate piles. The sample is collected approximately 5 feet from where this seep discharges into the creek. This particular sample is always highly contaminated; however, a significant variation in concentration is evident. For example, the uranium concentration ranges from 10 to 100 times the EPA interim standard. The standards are also exceeded for arsenic, molybdenum, selenium, and nitrate. There is no standard for vanadium, however, its concentration exceeds background by a factor of 10,000.

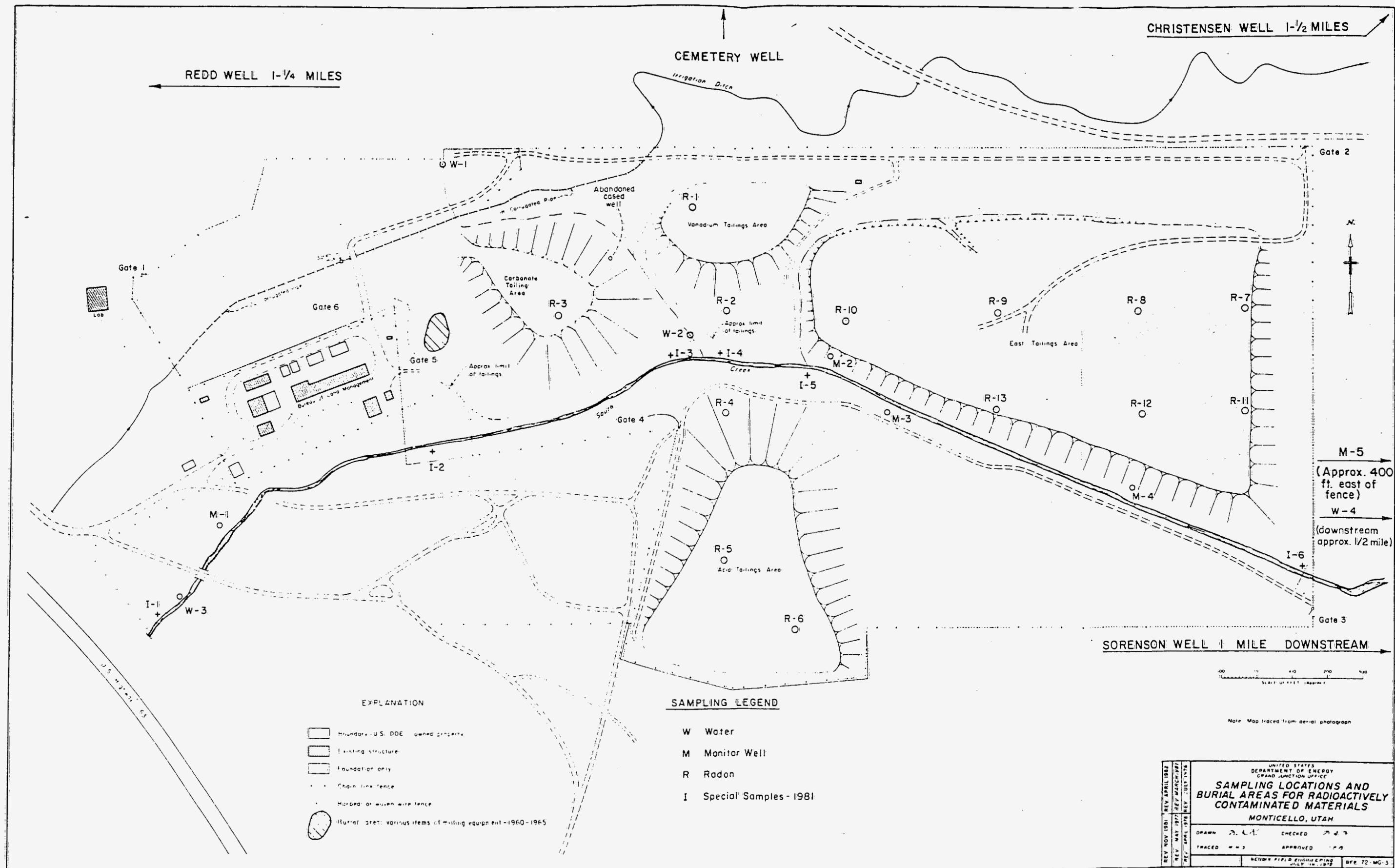


Figure 2. Sampling Locations and Burial Areas for Radioactively Contaminated Materials - Monticello, Utah

Table 8. Analyses of Surface Water Samples Collected at Monticello During 1981

Sample Site	Date Sampled	mg/l Ag	mg/l As	mg/l Ba	mg/l Cd	mg/l Cr	mg/l Pb	mg/l Hg	mg/l Mo	mg/l NO ₃ -N
W-3	7-81	<.0005	<.005	<0.2	<.001	<.005	<.002	<.002	.002	7
W-3	9-81	<.0005	<.005	0.13	<.001	<.005	<.002	<.002	.003	<1
W-3	11-81	<.0005	<.005	<0.2	<.001	<.005	<.002	<.002	<.002	<1
W-2	7-81	.0006	.37	<0.2	<.001	<.005	<.001	<.002	.86	5
W-2	9-81	.016	2.6	.17	<.001	<.005	.003	<.002	7.7	25
W-2	11-81	.008	3.3	.05	<.001	<.005	.002	<.002	8.9	188
W-4	7-81	<.0005	.011	<0.2	<.001	<.005	<.002	<.002	.086	5
W-4	11-81	.0005	.018	.08	<.001	<.005	<.002	<.002	.15	7
Sorenson	7-81	<.0005	.008	<0.2	<.001	<.005	<.002	<.002	.078	3
Sorenson	9-81	.002	.006	.15	<.001	<.005	<.002	<.002	.09	<1
Sorenson	11-81	.0005	<.005	.7	<.001	<.005	<.002	<.002	.095	2
EPA Standards		.05	.05	1.0	.01	.05	.05	.002	.05	10
Sample Site	Date Sampled	mg/l Se	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l V	mg/l Cl	mg/l SO ₄
W-3	7-81	<.005	.001	.7	6	5.3	<1	<.005	49	87
W-3	9-81	<.005	.001	<5	4	<1	<1	.014	8	57
W-3	11-81	<.005	.001	<5	17	<5	<1	<.005	10	92
W-2	7-81	.13	.22	152	206	4.9	<1	11.8	206	679
W-2	9-81	2.5	.490	340	826	10	<1	140	723	2096
W-2	11-81	1.8	3.26	2200	991	10	<1	115	1517	3006
W-4	7-81	.010	0.22	152	94	4.7	<1	.34	59	318
W-4	11-81	.02	2.12	1400	547	<5	<1	.66	107	469
Sorenson	7-81	.007	0.27	190	153	<1	<1	.18	70	389
Sorenson	9-81	.01	0.52	360	206	8	<1	.10	76	464
Sorenson	11-81	.015	0.97	660	262	9	<1	.07	55	338
EPA Standards		.01		10	15	5				

Sample W-4 is collected approximately one-quarter mile downstream from the east boundary of the pile. Once again the sample is significantly contaminated with uranium, molybdenum, selenium, and vanadium. Concentrations were greatest during the lowest stream-flow period.

The Sorenson site is located approximately 1 mile downstream. Uranium, molybdenum, and gross alpha all exceed EPA interim requirements. The levels again tended to increase with decreasing stream flow. At the two earliest samplings, the Sorenson site had higher concentrations of some contaminants than samples collected 1 mile closer to the tailings. This is a strong indication that the shallow aquifer alongside the creek is contaminated and enters the stream between the tailings area and the Sorenson site. A thorough hydrologic study is being conducted to fully explain these results.

Surface water sampling in September included several additional samples to better understand the surface water contamination. These data are shown in Table 9. The data are listed in order from upstream to downstream. The results for W-2, W-3, and Sorenson are the same as shown in Table 8.

The adequacy of W-3 as a background sampling site was checked by taking an additional sample 100 yards upstream on the opposite side of the highway. This was done because a surface radiation survey indicated higher- than background radiation in the vicinity. These data indicate W-3 is an acceptable location.

Contamination of the creek is evident even prior to the creek's traverse of the actual tailings piles. The sample I-2 taken immediately west of the carbonate pile is downstream from the old mill area. Uranium and vanadium are both contaminating this sample. Prior to the seep entering the creek at W-2, the carbonate pile only contributes vanadium which increases by a factor of four. After W-2, the concentrations of arsenic, molybdenum, vanadium, and uranium increase significantly. The next sample was collected immediately past the vanadium pile. Uranium, molybdenum, selenium, vanadium, and radium all continued to increase. At the east end of the property, arsenic and vanadium all reach their maximum value while uranium decreases slightly. An additional mile downstream, molybdenum and uranium reach their highest concentrations at the Sorenson site. This is evidence that the alluvial aquifer, as mentioned previously, contaminates the creek beyond the tailings area boundary.

The acid pile was not described in this interpretation because it is further from the creek and does not have visible seepage around its base as the other piles do. The contamination evidence in W-2 and one of the special samples described in the next section indicate that most of the surface water contamination comes from the north side of the creek.

SPECIAL SAMPLES

Several special samples were collected during the year. These data are presented in Table 10.

Table 9. Intensive Surface Water Sampling

Sample Site	Date Sampled	pH	$\mu\text{mhos/cm CDT}$	mg/l Ag	mg/l As	mg/l Ba	mg/l Cd	mg/l Cr	mg/l Pb	mg/l Hg	mg/l Mo	NO_3^{-}N
I-1 West of Highway Culvert	9-81	8.9	371	<.0005	<.005	.14	<.001	<.005	.003	<.002	.005	<1
W-3	9-81	9.0	370	<.0005	<.005	.13	<.001	<.005	<.002	<.002	.003	<1
I-3 S. Creek West of W-2	9-81	8.3	571	<.0005	.005	.13	<.001	<.005	<.002	<.002	.006	<1
I-4 S. Creek East of W-2	9-81	7.9	600	.0005	.013	.13	<.001	<.005	<.002	<.002	.034	<1
W-2	9-81	9.9	10650	.016	2.6	.17	<.001	<.005	.003	<.002	7.7	25
I-5 Between V and East Piles	9-81	8.5	610	<.0005	.015	.16	<.001	<.005	<.002	<.002	.04	<1
I-6 East of East Pile	9-81	8.7	578	.0005	.023	.12	<.001	<.005	<.002	<.002	.05	<1
Sorenson Site	9-81	8.4	1375	.002	.006	.15	<.001	<.005	<.002	<.002	.09	<1
I-2 West of CO_3 Pile	9-81	8.0	617	.0005	<.005	.16	<.001	<.005	<.002	<.002	.004	<1
I-7 EPA Standards				.05	.05	1.0	.01	.05	.05	.002	.05	10

Sample Site	Date Sampled	mg/l Se	mg/l U_3O_8	pCi/l U_3O_8	pCi/l Gross α	pCi/l ^{226}Ra	pCi/l ^{228}Ra	mg/l V	mg/l Cl	mg/l SO_4
West of Highway Culvert	9-81	<.005	.002	<5	7	$1 \pm .5$	<1	.029	8	57
W-3	9-81	<.005	.001	<5	4	<.5	<1	.014	8	57
S. Creek West of W-2	9-81	<.005	.039	27	22	$1 \pm .5$	<1	.11	9	75
S. Creek East of W-2	9-81	.008	.035	24	176	$1 \pm .5$	<1	.55	13	98
W-2	9-81	2.5	.490	340	826	9.8 ± 1	<1	140	723	2096
Between V and East Piles	9-81	.012	.055	38	26	14.1 ± 1	<1	.65	16	124
East of East Pile	9-81	.011	.048	33	26	10.5 ± 1	<1	.82	38	177
Sorenson Site	9-81	.01	.52	360	206	8.2 ± 1	<1	.1	76	464
West of CO_3 Pile	9-81	<.005	.033	23	22	8.0 ± 1	<1	.025	10	100
EPA Standards		.01		10	15		5			

Table 10. Analyses of Special Water Samples Collected Near the Monticello Site During 1981

Sample Site	Date Sampled	mg/l Ag	mg/l As	mg/l Ba	mg/l Cd	mg/l Cr	mg/l Pb	mg/l Hg	mg/l Mo	mg/l NO ₃ -N
Vanadium Seep	9-81	.01	.695	.8	<.001	.02	.03	<.002	.56	<1
Mill Well #1	9-81	<.0005	<.005	.14	<.001	<.005	<.002	<.002	.005	<1
Somerville Pond	7-81	<.0005	.006	<0.2	<.001	<.005	<.002	<.002	.016	2
Montezuma Creek	11-81	<.0005	<.005	.09	<.001	<.005	<.001	<.002	.02	2
EPA Standards		.05	.05	1.0	.01	.05	.05	.002	.05	10
Sample Site	Date Sampled	mg/l Se	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l V	mg/l Cl	mg/l SO ₄
Vanadium Seep	9-81	.07	4.8	3310	1390	17.2 \pm 2	<1	8.4	116	1052
Mill Well #1	9-81	<.005	.009	6	35	8.0 \pm 1	<1	.009	2	6
Somerville Pond	7-81	<.005	.047	32	25	<1	<1	.14	30	118
Montezuma Creek	11-81	<.005	0.21	142	117	8	<1	<.005	79	285
EPA Standards		.01		10	15		5			

Vanadium Seep: A sample was collected from an intermittent seep at the toe of the vanadium pile. This seep contained water in July and September but was dry in November. Obviously, the concentration in the seep would be closely related to the volume of water flowing. At the time of collection there was no surface connection to the creek; however, the location was less than 10 feet from the creek and would wash into it with even a brief rain. This sample was contaminated with uranium, arsenic, molybdenum, selenium, and radium. The uranium content is more than 3,000 times the EPA standard. Leakage is evident all along the toe of this pile. This is apparently a significant source of surface water contamination.

Mill Well #1: There is an old well located on the east side of the carbonate pile which reaches the underlying Dakota formation. A sample was bailed from this well to check for contamination of a deeper aquifer. Concentrations of the species measured were essentially at background levels. The high gross alpha cannot be easily explained based on the low uranium and radium values. The result is most likely in error.

Somerville Pond: The Somerville Pond is a farm pond located just east of the tailings area. This pond, as well as South Creek, is used to water livestock. The uranium concentration of the pond exceeds EPA standards. There are also above background levels of molybdenum and vanadium. This pond contained considerably more water in July when it was sampled than in September and November. Lower water levels probably concentrate the contaminants and increase the exposure to livestock. Beef cattle have been observed near the pond and creek.

Montezuma Creek: A sample was collected from Montezuma Creek approximately 5 miles from the tailings site and 2 miles below where South Creek enters. Both uranium and gross alpha significantly exceeded EPA standards. There is no way of knowing whether the tailings area contamination is related. However, this points out the need for a thorough hydrologic investigation to determine the extent of contamination from South Creek.

Sorenson Samples: The Sorenson sample is the same one shown on Table 8. The other samples (Table 11) were taken to obtain a better picture of the downstream contamination. The upstream sample was collected approximately 100 yards upstream from the actual Sorenson site. There are no apparent differences between the samples. The downstream Sorenson sample was collected an additional mile downstream, approximately 2 miles from the tailings property boundary. This sample is merely a diluted version of the Sorenson sample, yet, uranium, molybdenum, selenium, and gross alpha all exceed EPA standards.

Suspended Matter: All of the filtered suspended matter was analyzed from the samples collected in September. This includes samples from all of the surface water sites and several special locations. These data are presented in Table 12. It can be concluded from the low concentrations that the migration of contaminants in small suspended particles is not a factor at Monticello.

Ground Water: In the previous report, data were reported for monitoring wells M-1 through M-5. A site inspection revealed that these are not adequate monitoring wells. Although they permit sampling the shallow aquifer at a

Table 11. Special Samples Collected at the Sorenson Site

Sample Site	Date Sampled	mg/l Ag	mg/l As	mg/l Ba	mg/l Cd	mg/l Cr	mg/l Pb	mg/l Hg	mg/l Mo	mg/l NO ₃ -N
Sorenson	11-81	.0005	<.005	.7	<.001	<.005	.001	<.002	.095	2
Upstream Sorenson	11-81	<.0005	<.005	.6	<.001	<.005	<.001	<.002	.11	2
Downstream Sorenson	11-81	<.0005	<.005	.65	<.001	<.005	<.001	<.002	.08	1
EPA Standards		.05	.05	1.0	.01	.05	.05	.002	.05	10
Sample Site	Date Sampled	mg/l Se	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l V	mg/l Cl	mg/l SO ₄
Sorenson	11-81	.015	0.97	660	262	9.1	<1	.07	55	338
Upstream Sorenson	11-81	.019	1.01	686	192	7.4	<1	.09	67	327
Downstream Sorenson	11-81	.014	0.47	320	252	6.3	6.7	.05	66	359
EPA Standards		.01		10		5				

Table 12. Suspended Matter in Surface Water Samples

Sample Site	Date Sampled	mg/l Suspended										
		← U ₃ O ₈	Ag	Ba	Cd	Cr	Pb	Mo	V	Fe	Mn	Al
I-1 West of Highway Culvert	9-81	<.0002	.0004	.17	.0004	.004	.013	.004	.009	1.8	.02	.013
W-3	9-81	<.0007	.001	.066	<.001	.013	.007	.006	.02	4.0	.04	.037
I-3 S. Creek West of W-2	9-81	.0004	.0004	.02	.0004	.004	.003	.003	.01	1.6	.03	.017
I-4 S. Creek East of W-2	9-81	<.0002	.0004	.017	.0004	.004	.002	.001	.015	1.4	.03	.01
W-2	9-81	.002	.0004	.013	.0004	.003	<.002	.013	.19	.54	.015	.01
I-5 Between V and East Piles	9-81	<.0002	.0004	.014	.0004	.003	<.002	.002	.018	1.1	.03	.01
I-6 East of East Pile	9-81	<.0002	.0004	.01	.0004	.003	<.002	.002	.01	.65	.02	.01
Sorenson Site	9-81	.001	<.0005	.02	<.0005	.004	.003	.003	.02	1.9	.046	.02
Dakota Well	9-81	.02	.003	.04	.002	.012	.03	.008	.57	27.5	.32	.018
I-2 West of CO ₃ Pile	9-81	.0009	.0005	.014	.0004	.003	.003	.002	.007	1.3	.02	.01
Vanadium Seep	9-81	.014	.0004	.009	.0004	.004	.003	.004	.03	1.0	.03	.014

depth of 15 to 20 feet, they are perforated along their entire length. Casings are loose in some of the wells permitting material to fall in around the outside. Thus, data from these samples must be interpreted carefully and cannot be said to represent true ground-water conditions.

Data from these "wells" are shown in Table 13. Of these data, M-1 and M-5 are potentially the most useful. Both are located away from the tailings area. Thus, M-1 may represent background conditions and M-5 what is migrating in the shallow aquifer.

M-1 has a higher-than-expected level for uranium but is much less contaminated than the other wells. M-5 is considerably contaminated with uranium, molybdenum, vanadium, and gross alpha. These are the same elements contaminating the creek at the Sorenson site. They are also found in higher concentration than in the creek nearby. Hence, the hypothesis that some of this shallow aquifer contaminates the creek below the tailings area is plausible. This shallow aquifer may also be the source of contamination to the Somerville Pond.

Obviously, these data have significant implications for remedial action programs. Merely preventing surface runoff is unlikely to eliminate contamination to the creek or the pond.

IMPROVEMENT PROGRAM

Final decontamination and decommissioning of the Monticello site have been authorized as part of the Surplus Facilities Management Program. A detailed site characterization study is currently underway and will be completed by the end of FY1983. The study will provide sufficient data and engineering analysis to determine if the tailings can be stabilized-in-place or must be moved to a more environmentally suitable location.

Table 13. Analyses of Well Water Samples Collected at the Monticello Site During 1981

Well Site	Date Sampled	mg/l Ag	mg/l As	mg/l Ba	mg/l Cd	mg/l Cr	mg/l Pb	mg/l Hg	mg/l Mo	mg/l NO ₃ -N
M-1	7-81	<.0005	.005	<0.2	<.001	<.005	.001	<.002	.004	<1
M-1	11-81	<.0005	<.005	.35	<.001	<.005	<.001	<.002	<.002	<1
M-2	7-81	.0007	.003	<0.2	<.001	<.005	<.001	<.002	.007	<1
M-2	11-81	.0005	.03	.06	<.001	<.005	<.001	<.002	.005	26
M-3	7-81	.004	<.001	<0.2	<.001	<.005	.012	<.002	.011	123
M-3	11-81	.004	<.005	.03	<.001	<.005	<.001	<.002	.003	527
M-4	7-81	.0005	<.001	<0.2	<.001	<.005	<.001	<.002	.81	2
M-4	11-81	<.0005	<.005	.1	<.001	<.005	<.001	<.002	.67	--
M-5	7-81	.0005	.006	<0.2	<.001	<.005	<.001	<.002	.16	2
M-5	11-81	<.0005	.012	.16	<.001	<.005	<.001	<.002	.06	<1
EPA Standards		.05	.05	1.0	.01	.05	.05	.002	.05	10

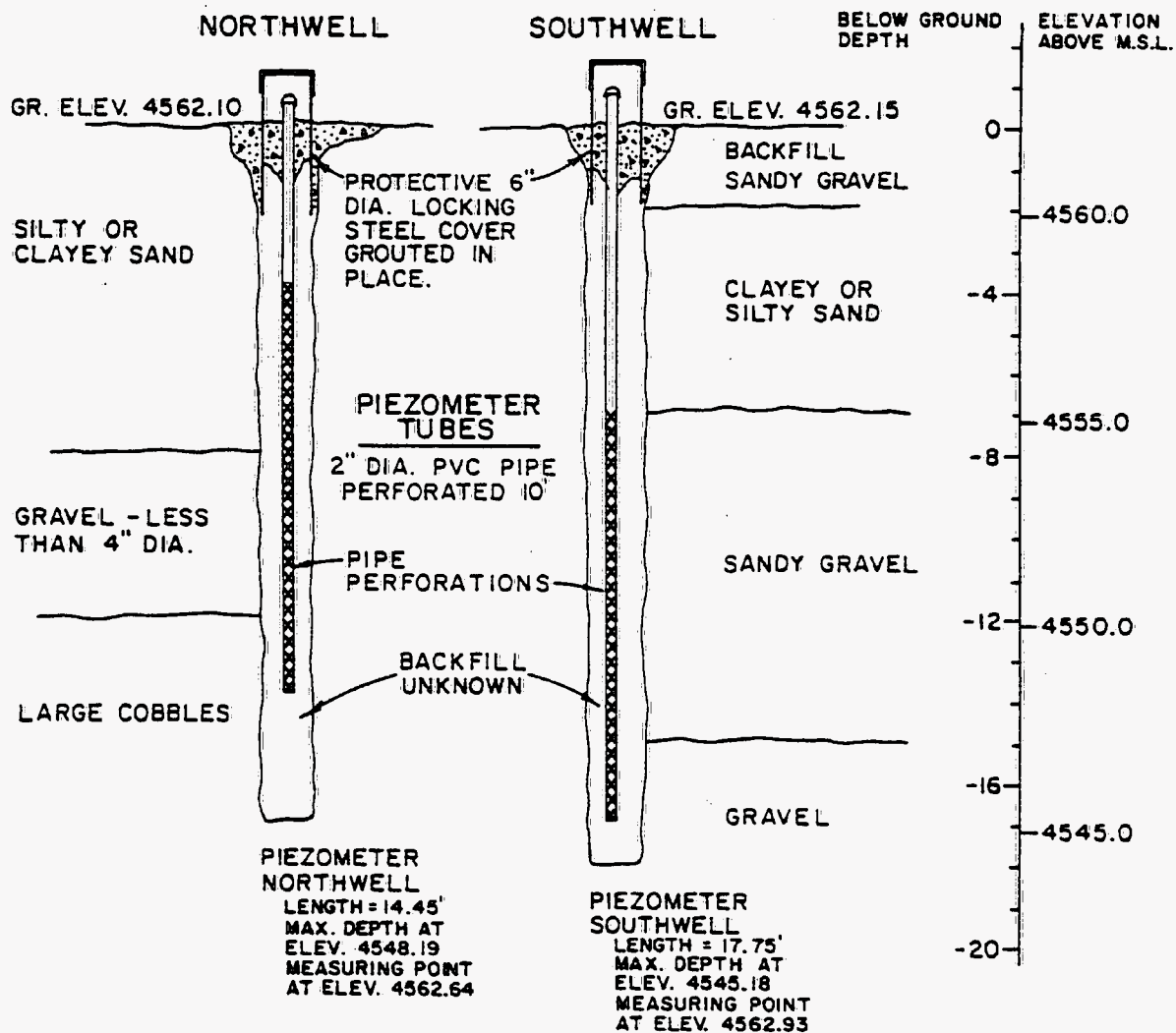
Table 13. Analyses of Well Water Samples Collected at the Monticello Site During 1981 (continued)

Well Site	Date Sampled	mg/l Se	mg/l U ₃ O ₈	pCi/l U ₃ O ₈	pCi/l Gross α	pCi/l ²²⁶ Ra	pCi/l ²²⁸ Ra	mg/l V	mg/l Cl	mg/l SO ₄
M-1	7-81	<.005	0.13	90	75		<1	.022	13	86
M-1	11-81	<.005			32			<.005	19	6
M-2	7-81	<.005	1.2	830	486	<1	<1	.024	194	1126
M-2	11-81	<.005	1.78	1210	711			.03	133	789
M-3	7-81	.072	1.9	1310	836	<1	4.3	.012	62	3148
M-3	11-81	.097	3.17	2155	1375			<.005	44	1870
M-4	7-81	.007	1.9	1310	1024	14.0	4.5	<.005	37	358
M-4	11-81	<.005	5.41	3680	2447			.006	--	--
M-5	7-81	.009	0.96	660	596	<1	<1	.22	137	666
M-5	11-81	<.005	0.96	660	325			.03	92	307
EPA Standards		.001		10	15		5			

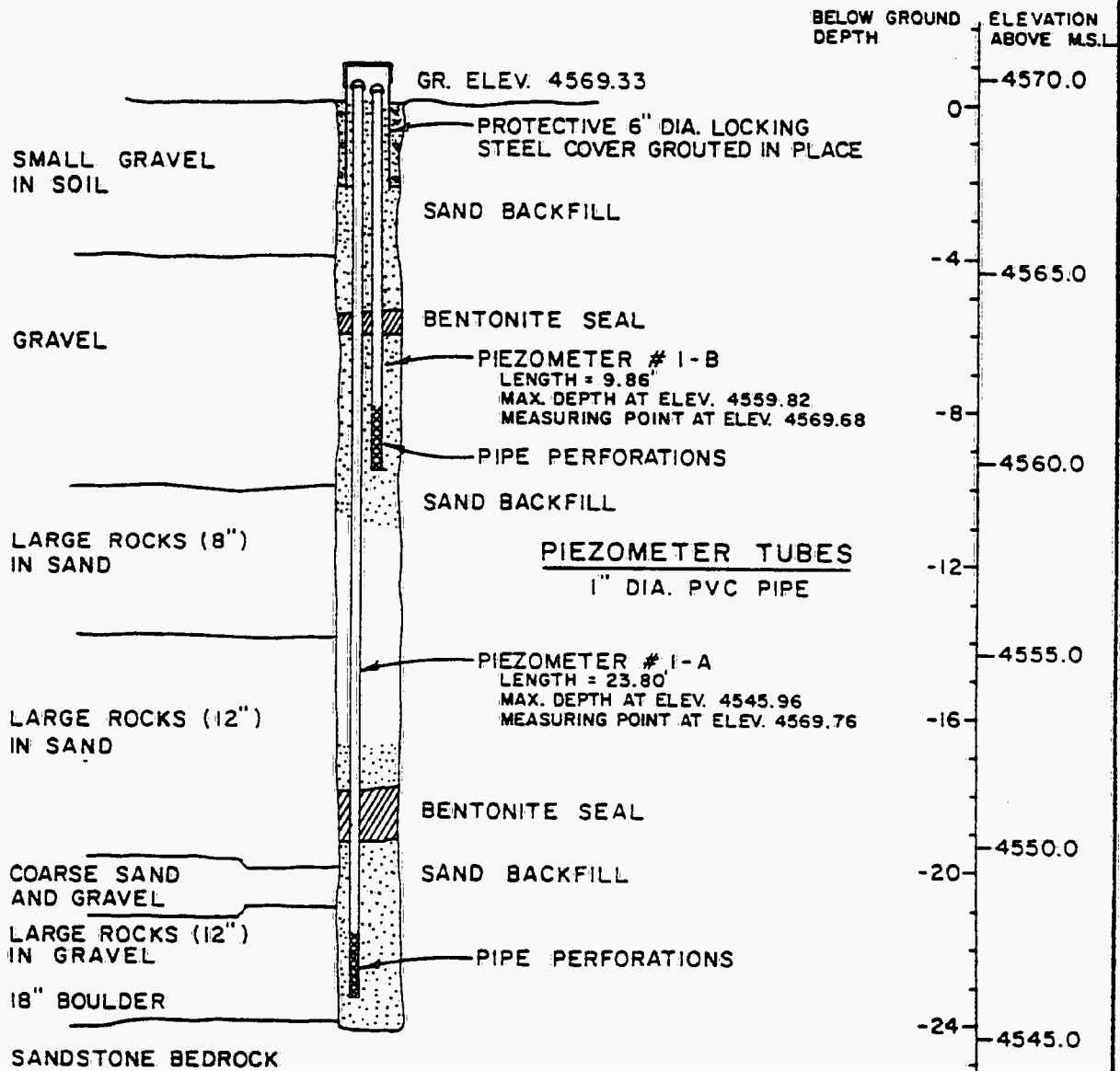
APPENDIX A.

PIEZOMETER INSTALLATIONS

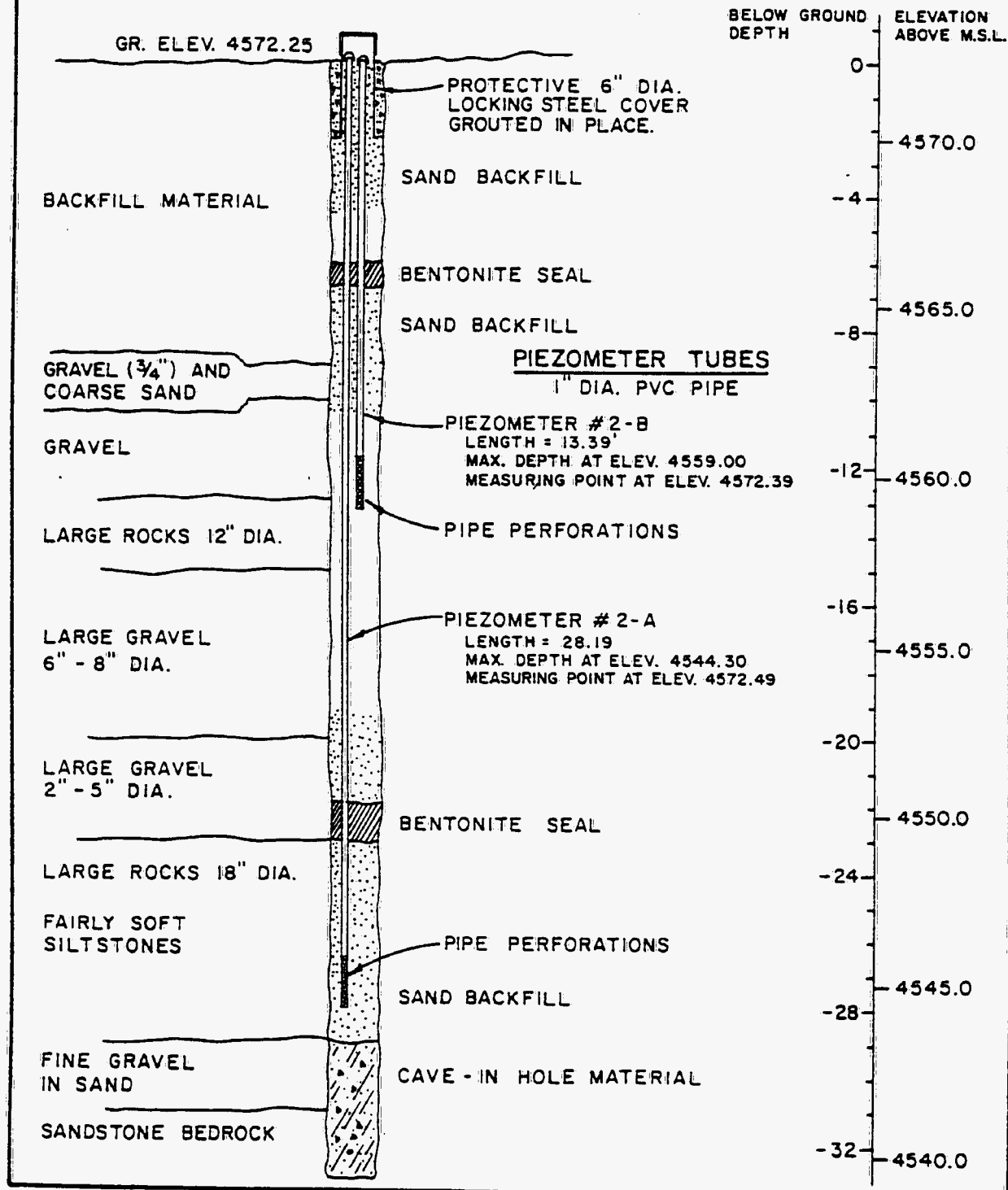
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 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
NORTH AND SOUTH WELL
 PIEZOMETER INSTALLATIONS
 INSTALLED BY ARMSTRONG ENGINEERS AND ASSOCIATES, INC.



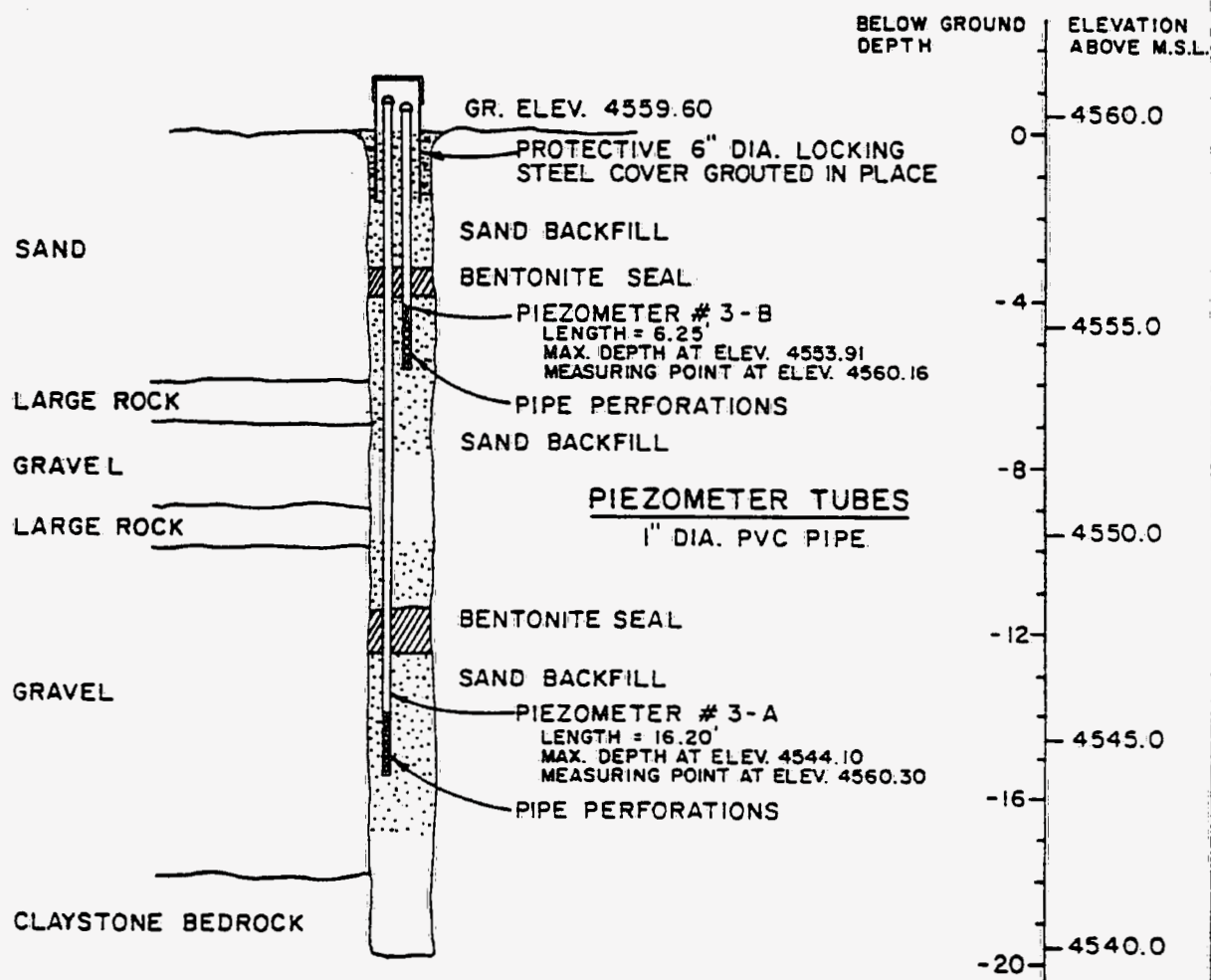
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 GRAND JUNCTION, COLORADO
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DRILL HOLE NO. 1
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 8/19/81



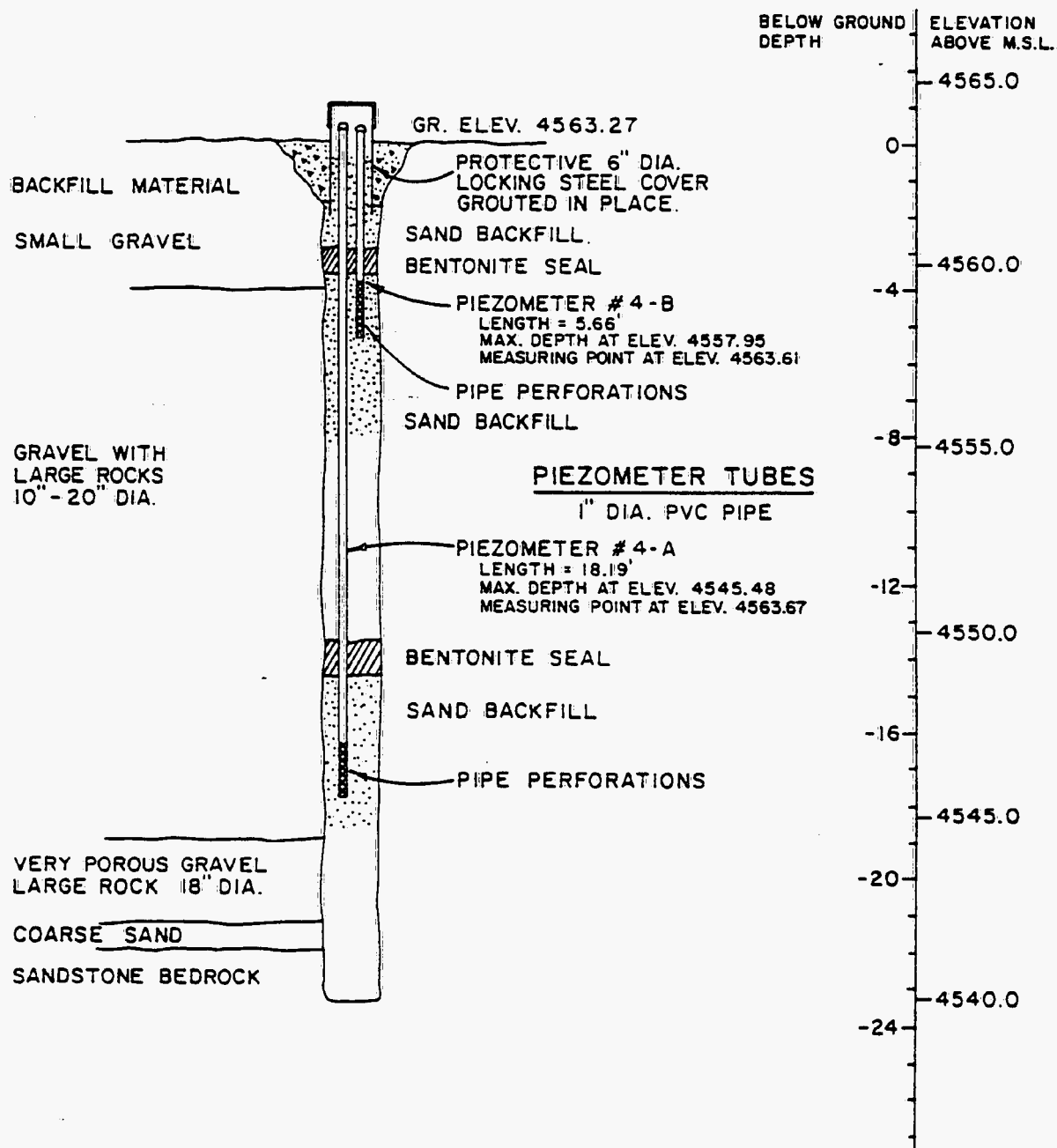
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 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 2
PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 8/21/81



U.S. DEPARTMENT OF ENERGY COMPOUND
 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 3
PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 8/25/81

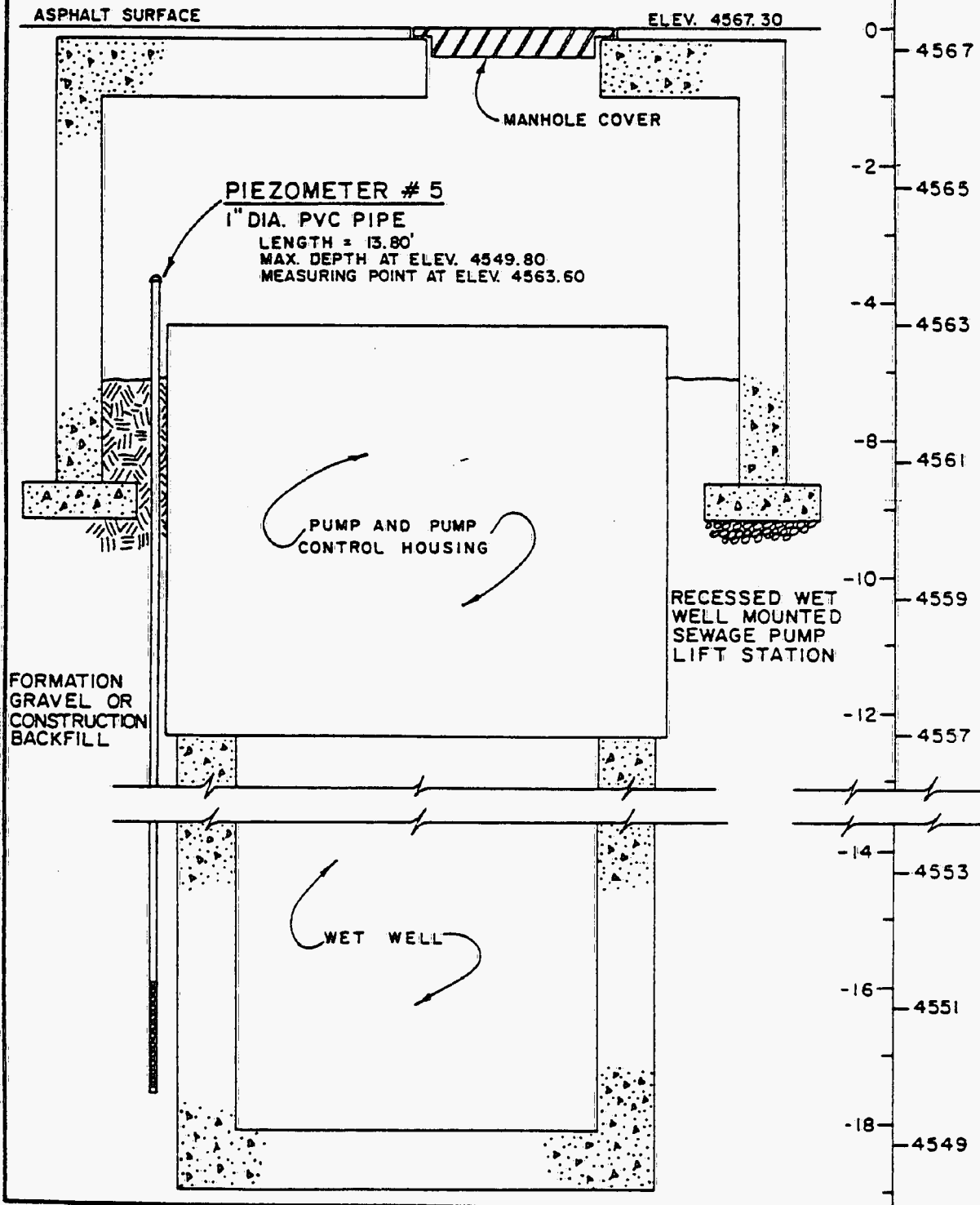


U.S. DEPARTMENT OF ENERGY COMPOUND
 GRAND JUNCTION, COLORADO
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DRILL HOLE NO. 4
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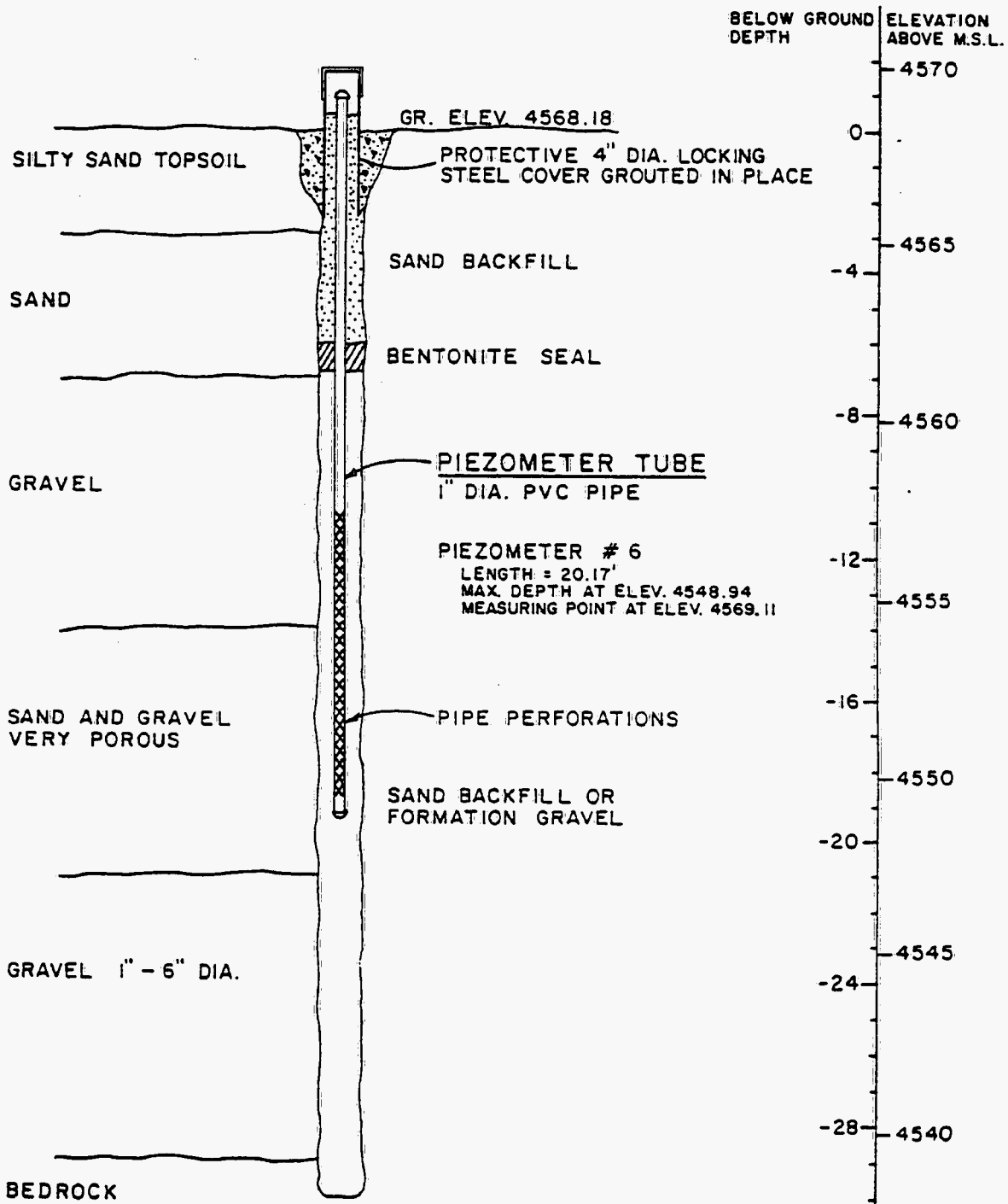


U.S. DEPARTMENT OF ENERGY COMPOUND
 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
 DRILL HOLE NO. 5
 PIEZOMETER INSTALLATIONS

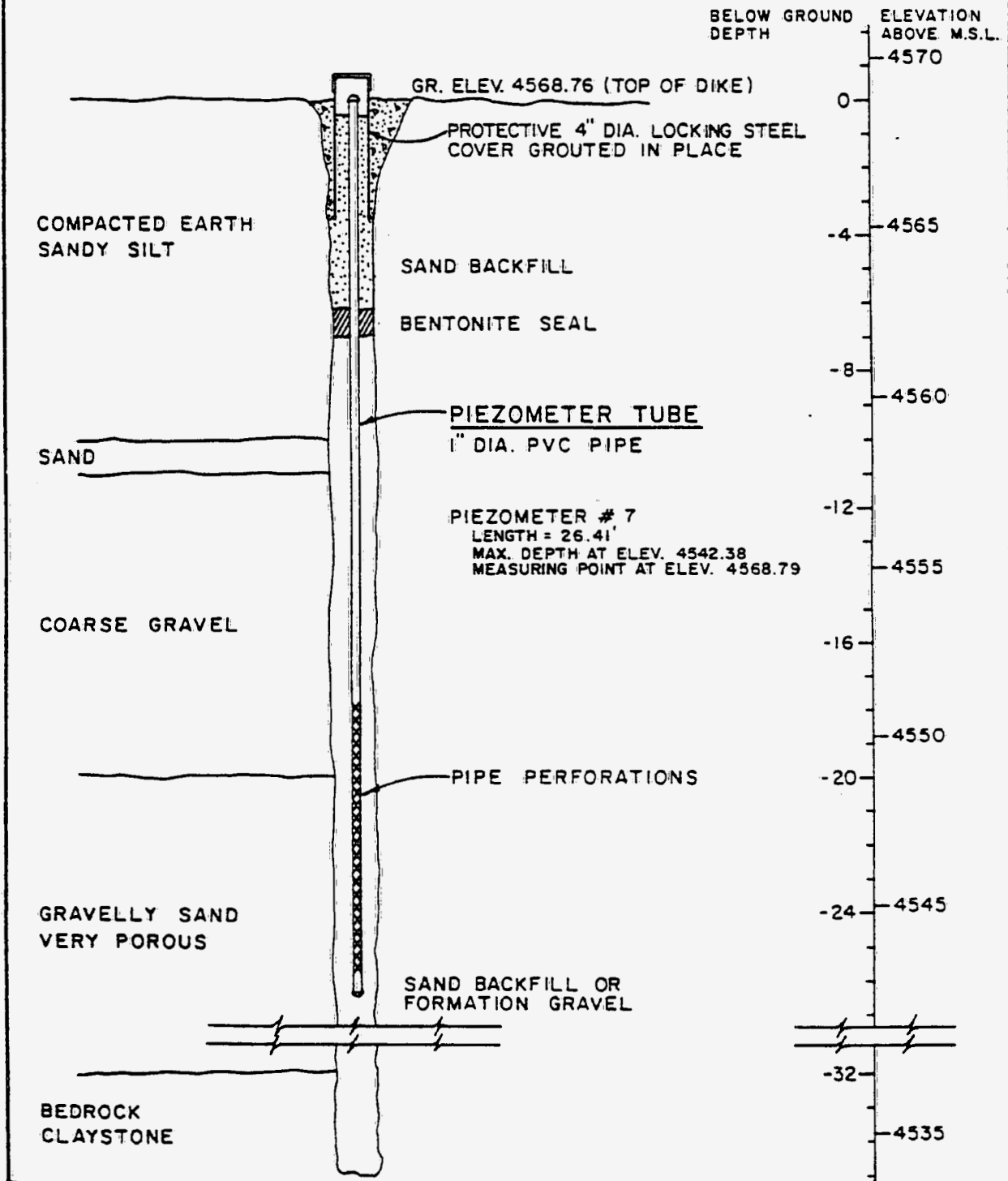
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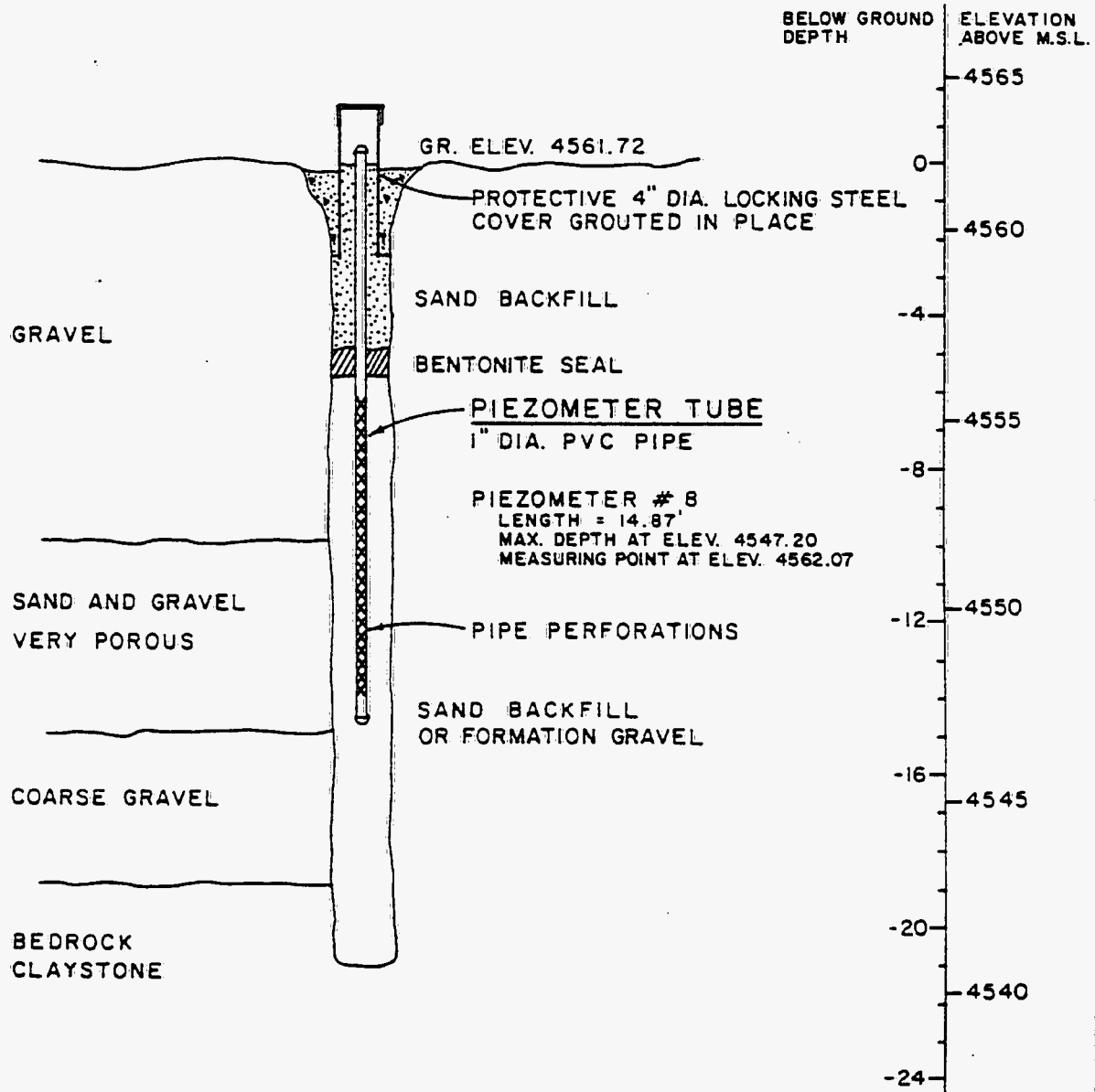
U.S. DEPARTMENT OF ENERGY COMPOUND
 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 6
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 9/16/81



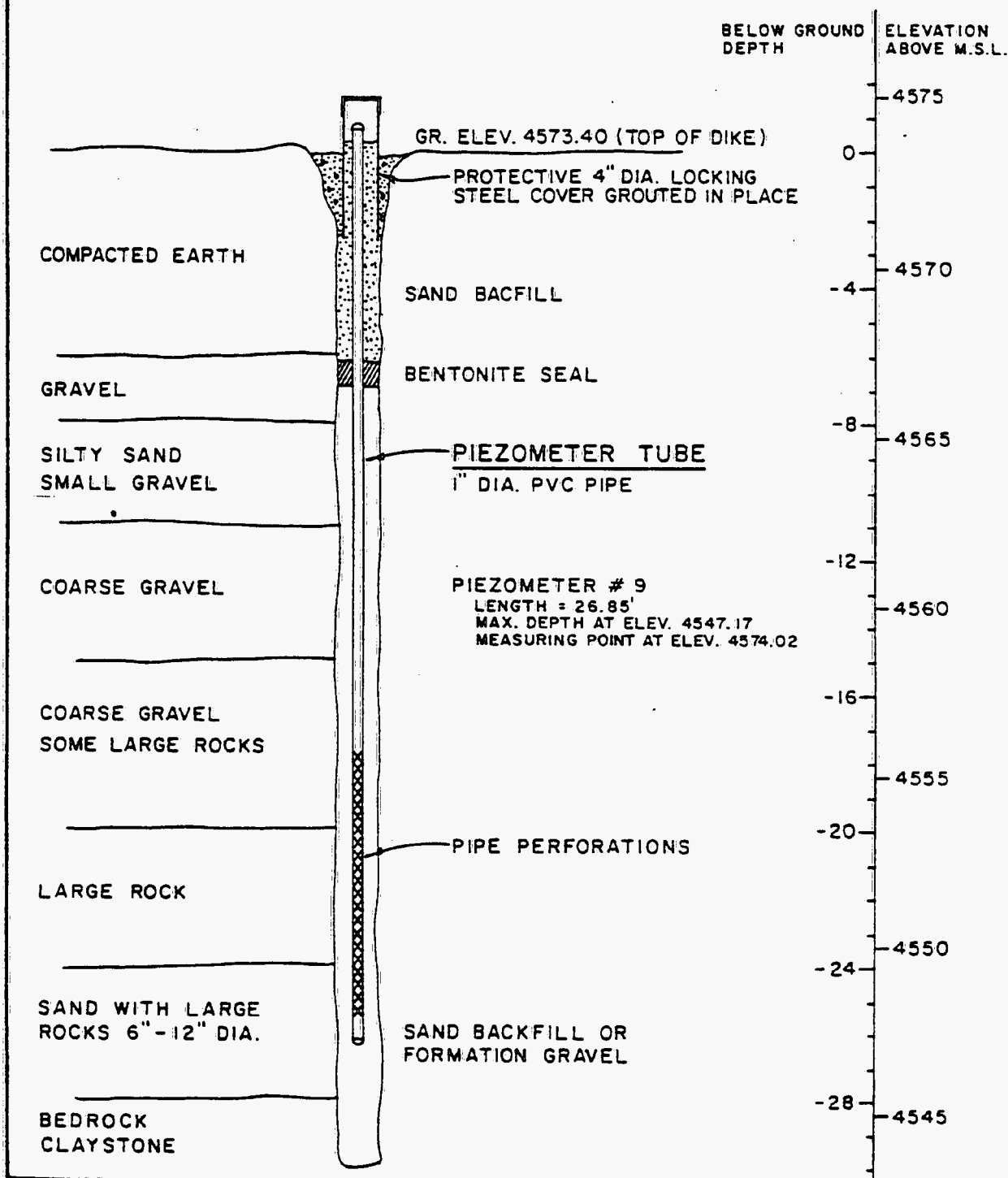
U.S. DEPARTMENT OF ENERGY COMPOUND
 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 7
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 9/22/81



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 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 8
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 9/16/81



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 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 9
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 9/17/81



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 GRAND JUNCTION, COLORADO
 BENDIX FIELD ENGINEERING CORP.
DRILL HOLE NO. 10
 PIEZOMETER INSTALLATIONS
 INSTALLED BY WESTERN ENGINEERS, INC. ON 9/21/81

